8. SUMMARY AND CONCLUSIONS

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A reef restoration feasibility study was conducted for the Acadiana Bays area by a team of engineering and surveying firms and the Louisiana Department of Natural Resources. The technical team was managed by Waldemar S. Nelson & Co., Inc., of New Orleans, Louisiana; the firm also performed the preliminary engineering evaluation of alternative reef structures. Surveying, both bathymetric and topographic, was performed by John Chance Land Surveys, Inc., of Lafayette, Louisiana. An extensive mathematical modeling program was conducted to evaluate hydrodynamics and water quality parameters. This program was performed by Taylor Engineering, Inc., of Jacksonville, Florida. The geotechnical evaluation was conducted by Lourie Consultants of Metairie, Louisiana. The LSU Coastal Studies Institute's activities, managed by Dr. Greg Stone, consisted of placement of a marine and meteorological gage package which monitored water level, current, wave conditions and other parameters. This station was operated for a period of four months, with the data used in the modeling exercises.

The majority of the effort in this project phase was dedicated toward the modeling program. Made early in the project planning, this decision was based on the premise that the first objective of this project phase should be to determine whether the ultimate project goals and objectives could be met with placement of reef-like structures in the bay area. The primary goal and objective of the overall project was to determine if structure placement in the bays, given current hydrodynamics of fresh water flows in the area, could significantly influence the present salinity and turbidity conditions in the western bays with an aim toward approaching the anecdotal historical conditions. The two components of the modeling program included the acquisition of existing bathymetry data in the bay system and the modeling itself. Each of these programs has been detailed in their respective sections in this report. The modeling program and results are detailed in their entirety in Appendix A.

The project team felt that the models developed to simulate change in conditions due to reef placement were adequate for that use given the close comparison of model predictions with measured existing conditions during the models' validation phase. The following summarizes the results of the overall study:

- The models demonstrated, during the calibration and validation phase, reasonable predictions of existing conditions. Therefore, the models developed for the program should yield reasonable estimates of condition changes due to reef structure placement.
- The prevalent muddy bottom conditions in the bays cause, at least for normal water levels, significant dampening of waves; this process had to be accounted for in the wave propagation modeling.
- Of the two alternative reef top elevations (-3 ft mean low water [MLW] and mean high water [MHW]), the lower reef elevation did not noticeably affect existing conditions of salinity and turbidity regardless of reef alignment.
- A complete blockage of flows from the Lower Atchafalaya River and Wax Lake Outlet into the western bays (reference reef alignment B) does not significantly increase salinity levels in the western bays as it also significantly cuts off salt water input from the Gulf. Reef alignment A does exhibit a more substantial change in salinity levels in the Cote Blanche Bays than alignment B for the mean fresh water flow conditions evaluated. This alignment allows salt water from the Gulf to enter the western bays. This effect on salinity level (concentration) increase is limited to two to three parts per thousand. Alignment C, a segmented reef due south from Point Chevreuil, produced higher salinities offshore, but changed salinity only minimally in the interior bays.
- Turbidity levels are also reduced in the western bays with alignment A but not as significantly as with alignment B. Turbidity effects were not evaluated for alignment C.
- Reef alignment B exhibited the greatest effect on storm surges along the northern Acadiana Bays shorelines; however, the reduction in surge was only one-half foot, or about 5%.

- From a preliminary engineering perspective, given the assumptions made on poor strength of bay bottoms, the restoration of historical reefs in this area would prove to be an expensive project. If the assumptions on soil strength are correct, then a large cross section (bottom width) would be necessary to construct the reef. The reef would have to be reasonably well armored to prevent erosion due to increased currents; thus, an all-sand type structure would not be practical. This study did make an initial evaluation of alternative construction means which could improve soil strength leading to reduced cross sections. The approach of utilizing deep soil mixing to improve the foundation did provide significant savings to the estimated construction costs.

- Estimated construction costs for the reef alternatives which crested at MHW ranged from just over $100 Million to almost $400 Million depending upon alternative alignment and type of construction. While the alternatives cresting at – 3 ft MLW were less expensive, these had minimal effect on water quality parameters of interest in this study.

- It would most likely be possible to reduce these estimated costs of reef construction if a more detailed surveying and geotechnical evaluation was performed specifically in the area of anticipated reef placement.

- Given the relatively small anticipated increases in salinity due to construction of any of the reef alternates it would not be reasonable to expect significant improvement to habitat conditions for desirable marine species. A separate evaluation of changes in habitat suitability indicates that the habitat suitability would probably not change for brown or white shrimp (current salinities are non-limiting), but would only increase marginally for spotted seatrout in three stations.

- A model run using historical hydrology was conducted. This model run reflected the configuration and flow conditions before the construction of the Gulf Intracoastal Waterway, the Wax Lake Outlet, and the Old River Control Structure, which increased flow through the Atchafalaya River.

This model run produced the anecdotal historical brackish conditions in the bays. Under these conditions, the habitat suitability for spotted seatrout would have been much higher than existing conditions. This indicates that the changes in these fresh water inputs probably had more impact on the bays' salinity regime than removal of the reefs.